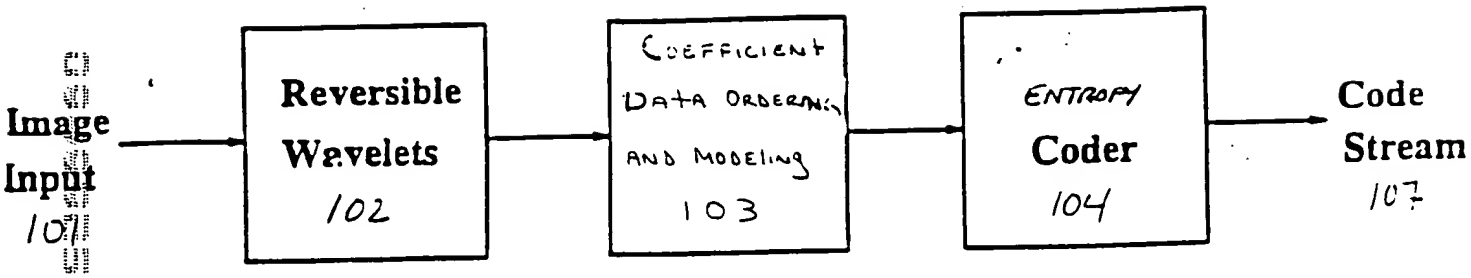


Image Input
101
Reversible Wavelets
102
Coefficient Data Ordering and Modeling
103
Entropy Coder
104
Code Stream
107

FIGURE 1

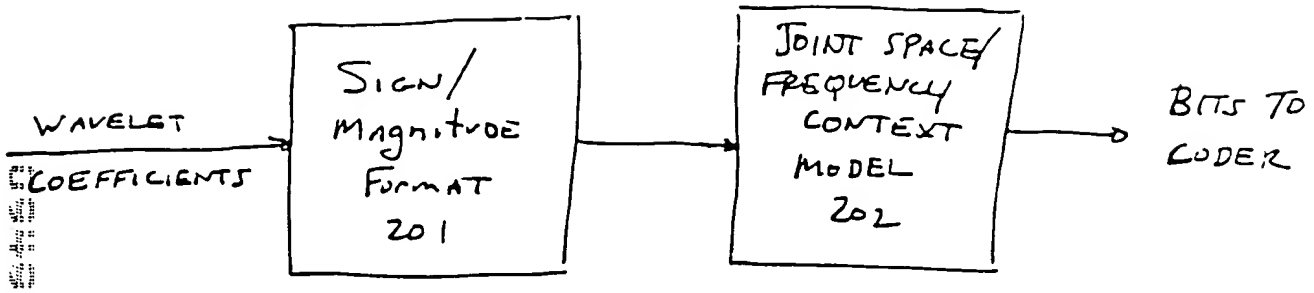

WAVELET
COEFFICIENTS
SIGN/
MAGNITUDE
FORMAT
201
JOINT SPACE/
FREQUENCY
CONTEXT
MODEL
202
BITS TO
CODER

Figure 2

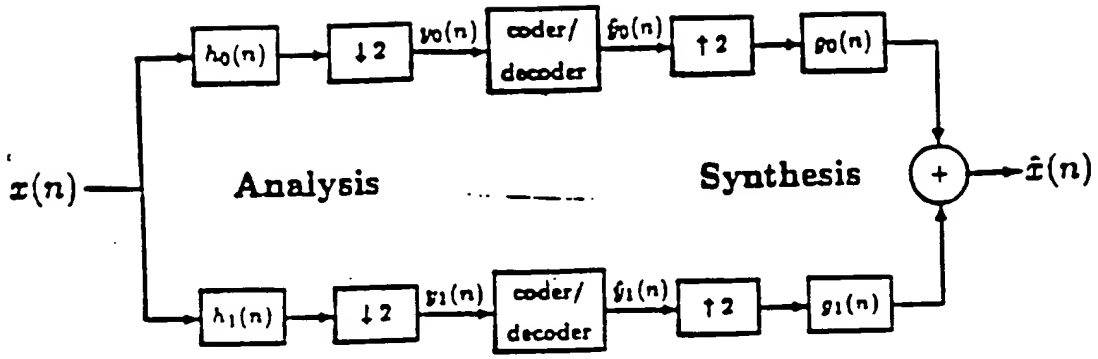

$h_0(n)$
↓2
$y_0(n)$
coder/
decoder
$\hat{y}_0(n)$
↑2
$g_0(n)$
$x(n)$
Analysis
Synthesis
+
$\hat{x}(n)$
$h_1(n)$
↓2
$y_1(n)$
coder/
decoder
$\hat{y}_1(n)$
↑2
$g_1(n)$

FIGURE 3A

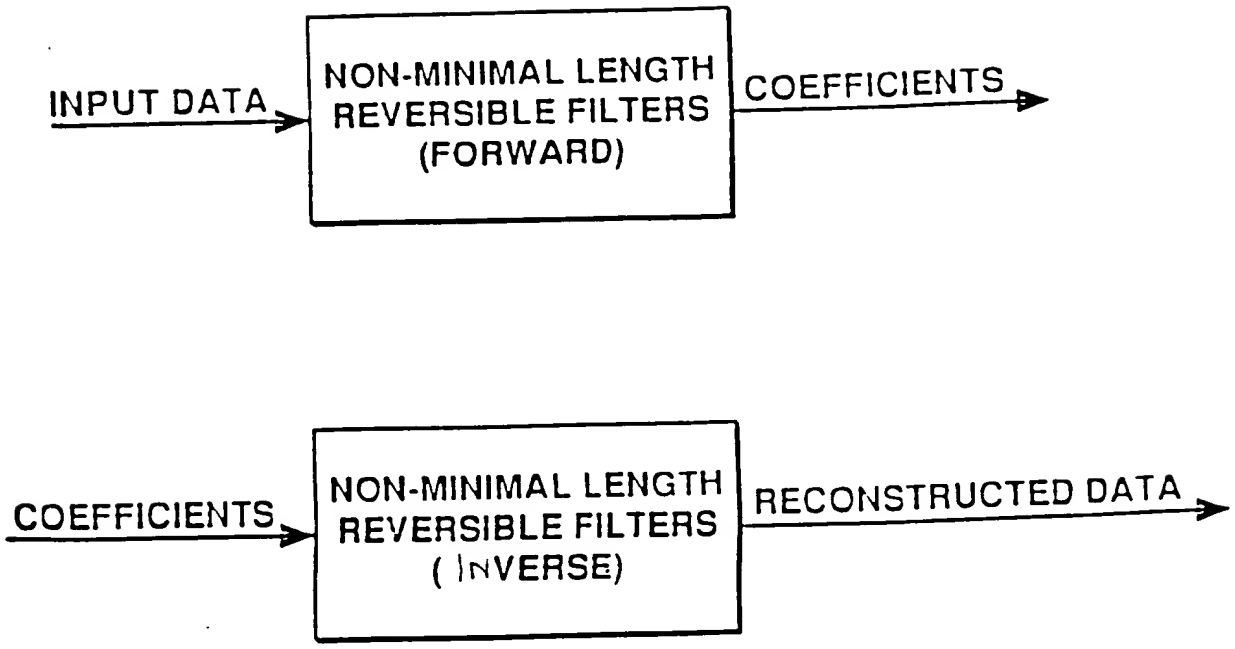

INPUT DATA
NON-MINIMAL LENGTH REVERSIBLE FILTERS (FORWARD)
COEFFICIENTS
COEFFICIENTS
NON-MINIMAL LENGTH REVERSIBLE FILTERS ( INVERSE)
RECONSTRUCTED DATA

Figure 3B

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

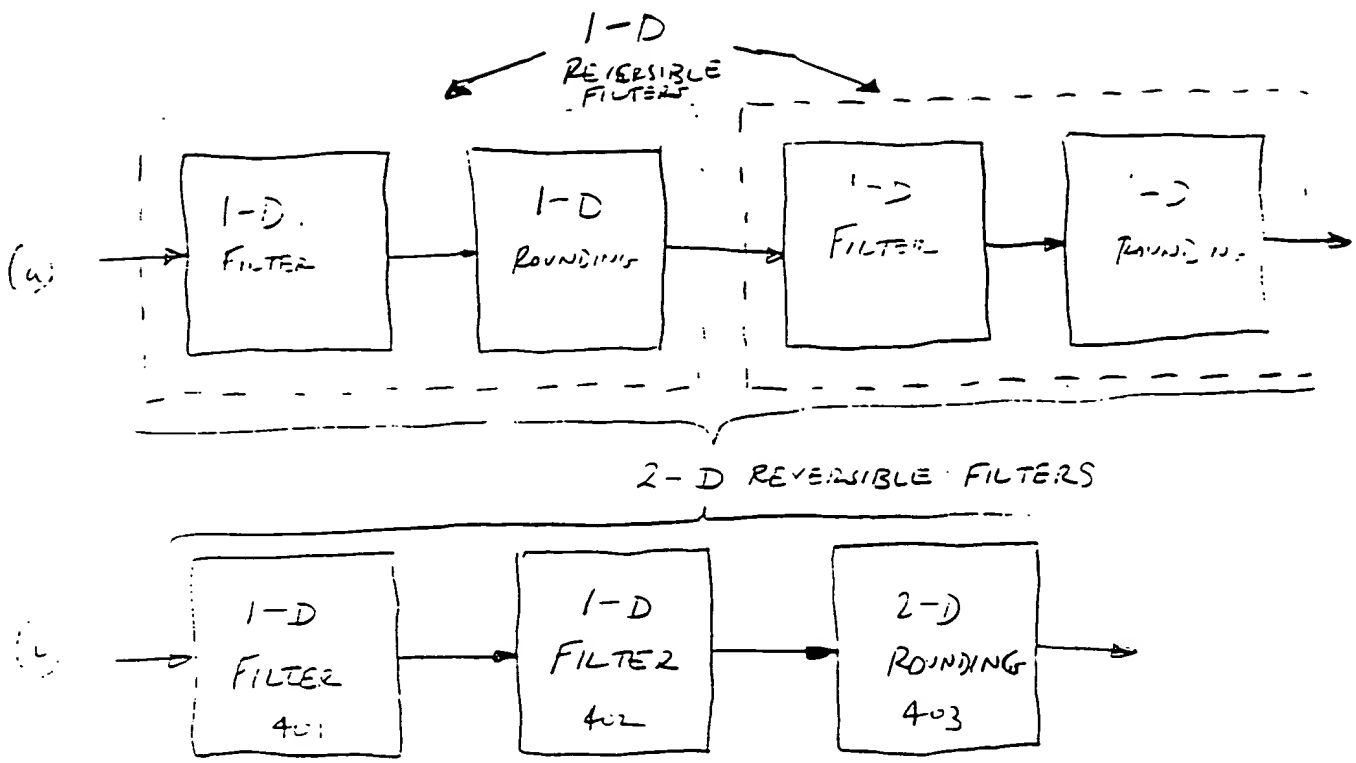



Figure 4

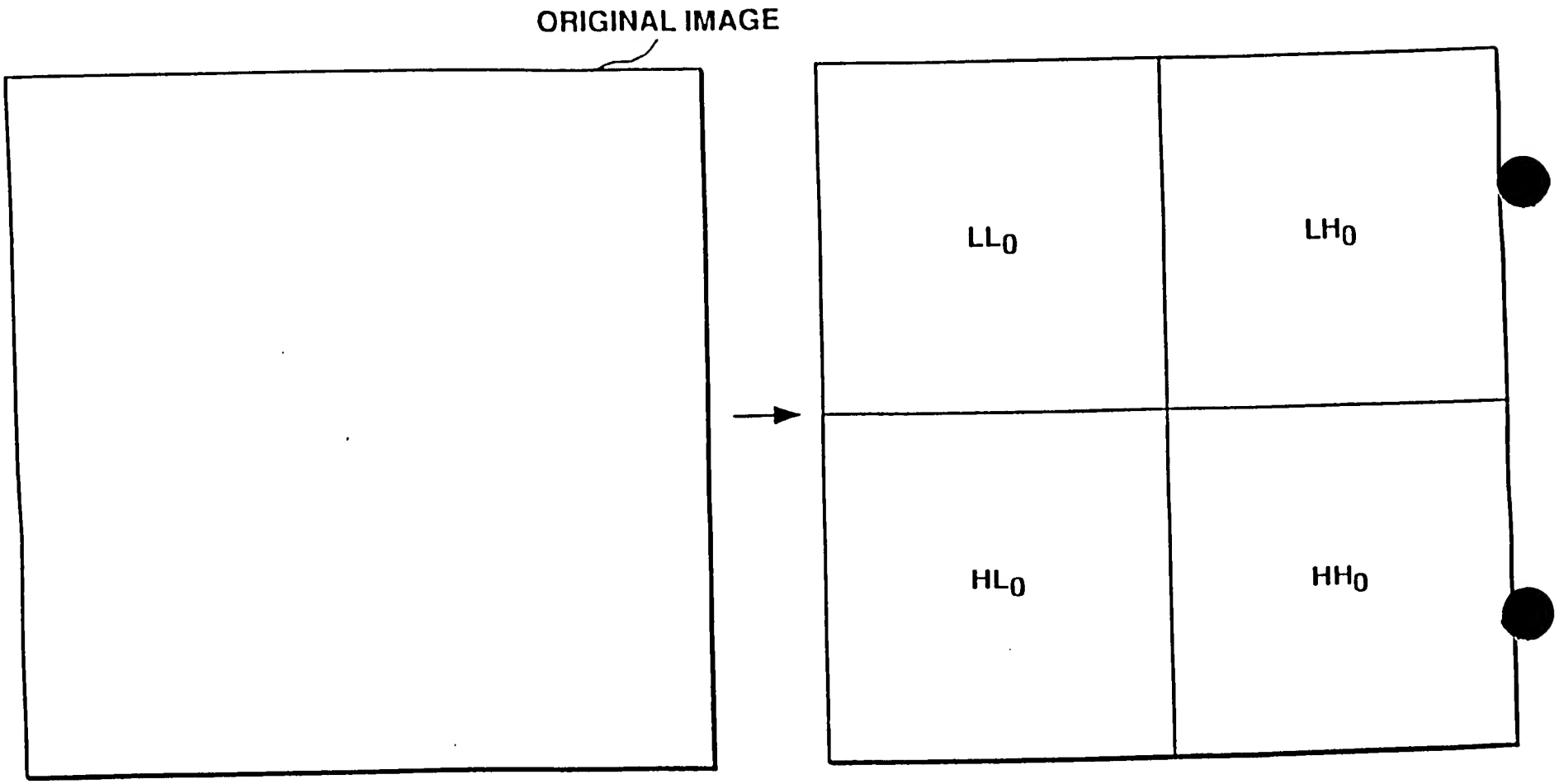



*Figure 5A*

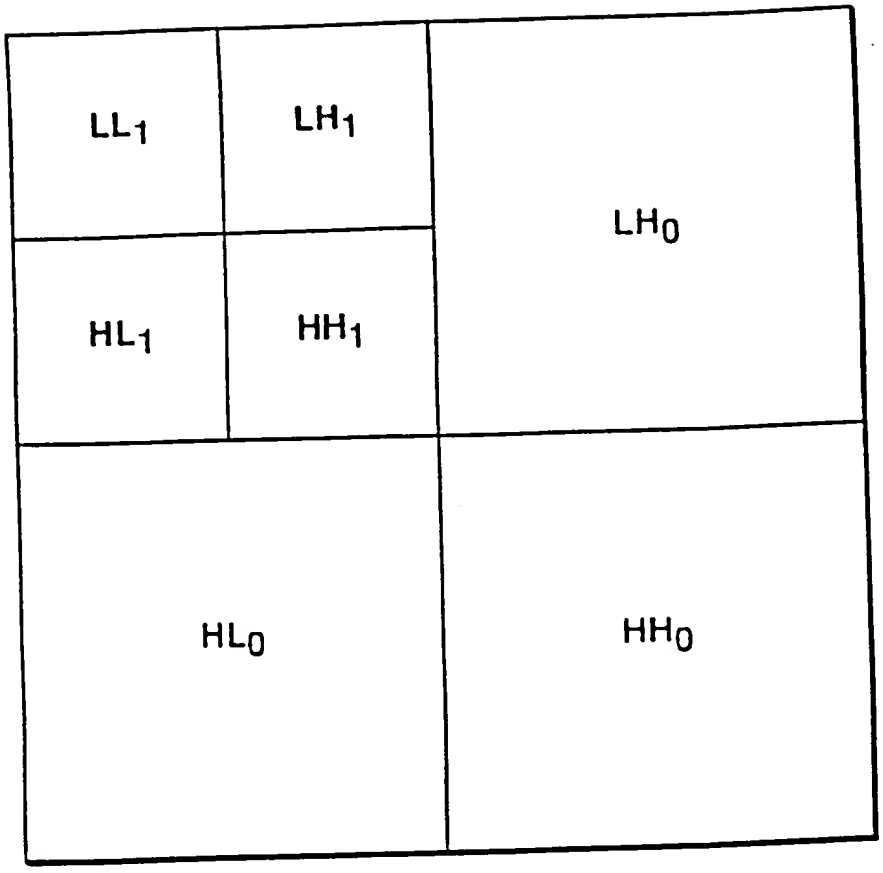



Figure 5B

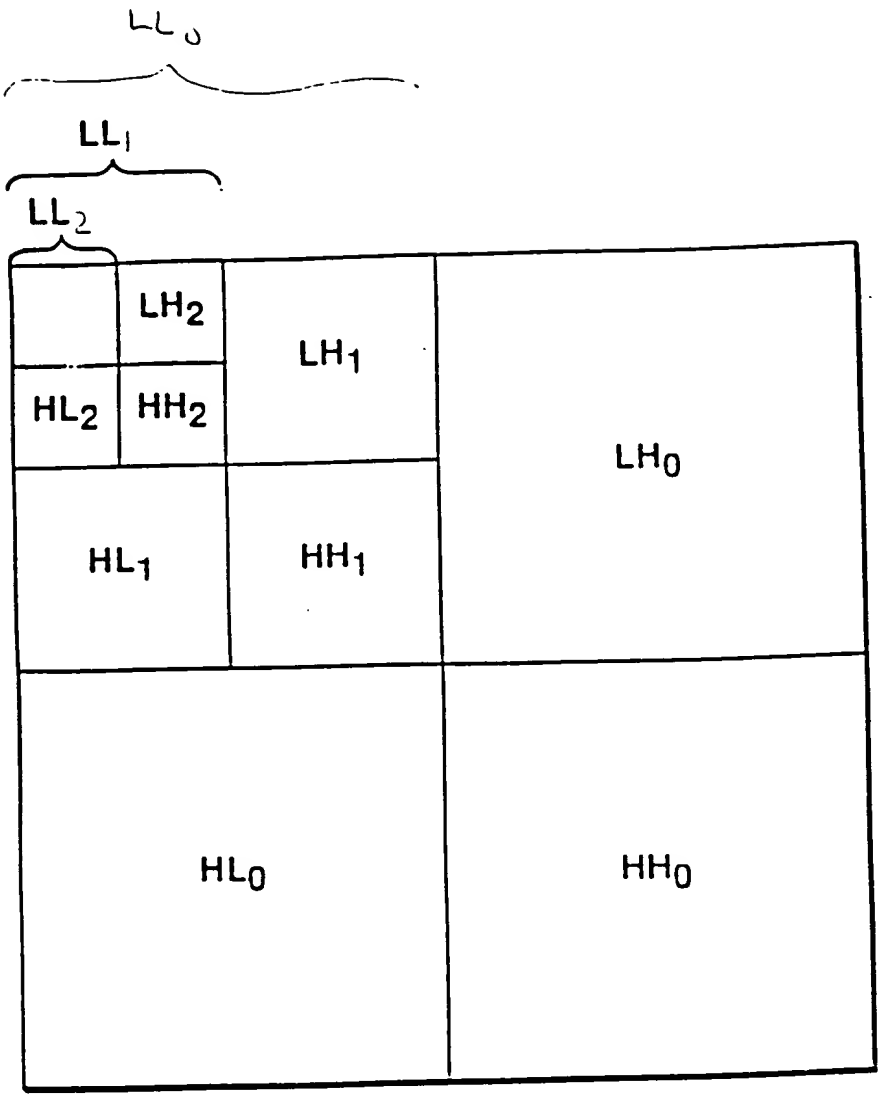



Figure 5C

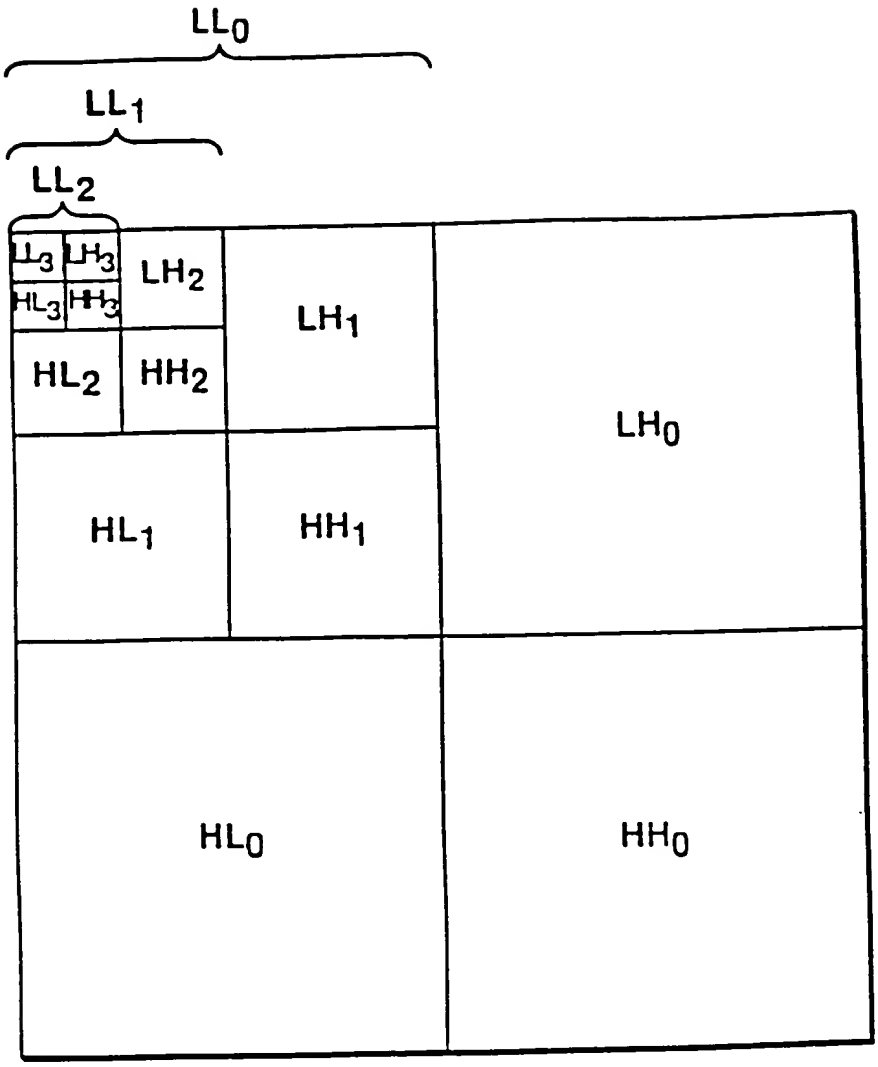



Figure 5D

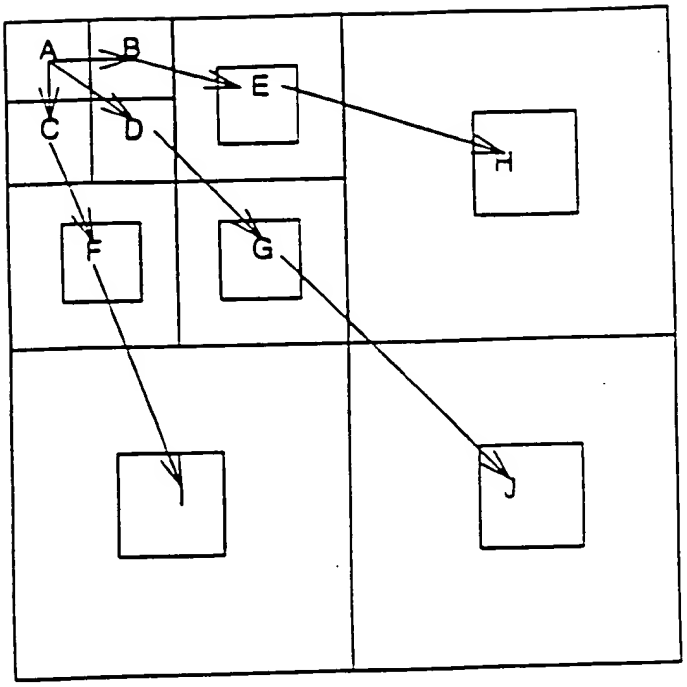
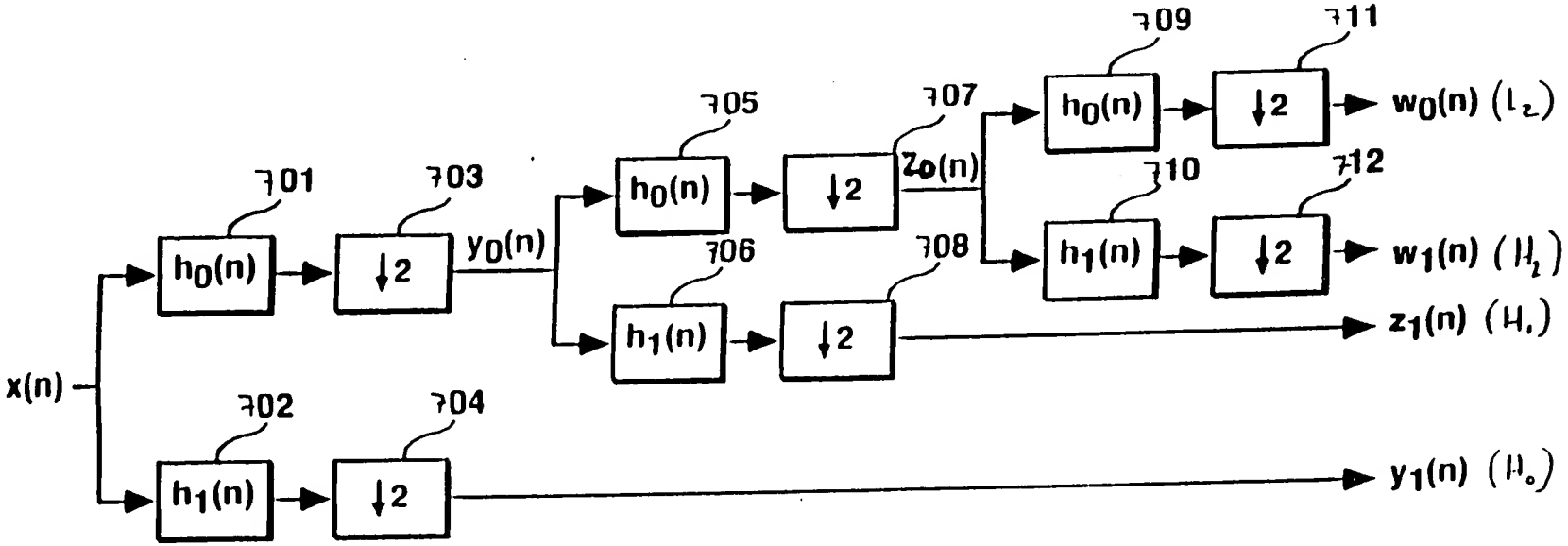



Figure 6


x(n)
h0(n)
701
↓2
703
y0(n)
h1(n)
702
↓2
704
h0(n)
705
↓2
z0(n)
707
h1(n)
706
↓2
708
h0(n)
709
↓2
711
w0(n) (L2)
h1(n)
710
↓2
712
w1(n) (H1)
z1(n) (H1)
y1(n) (H0)

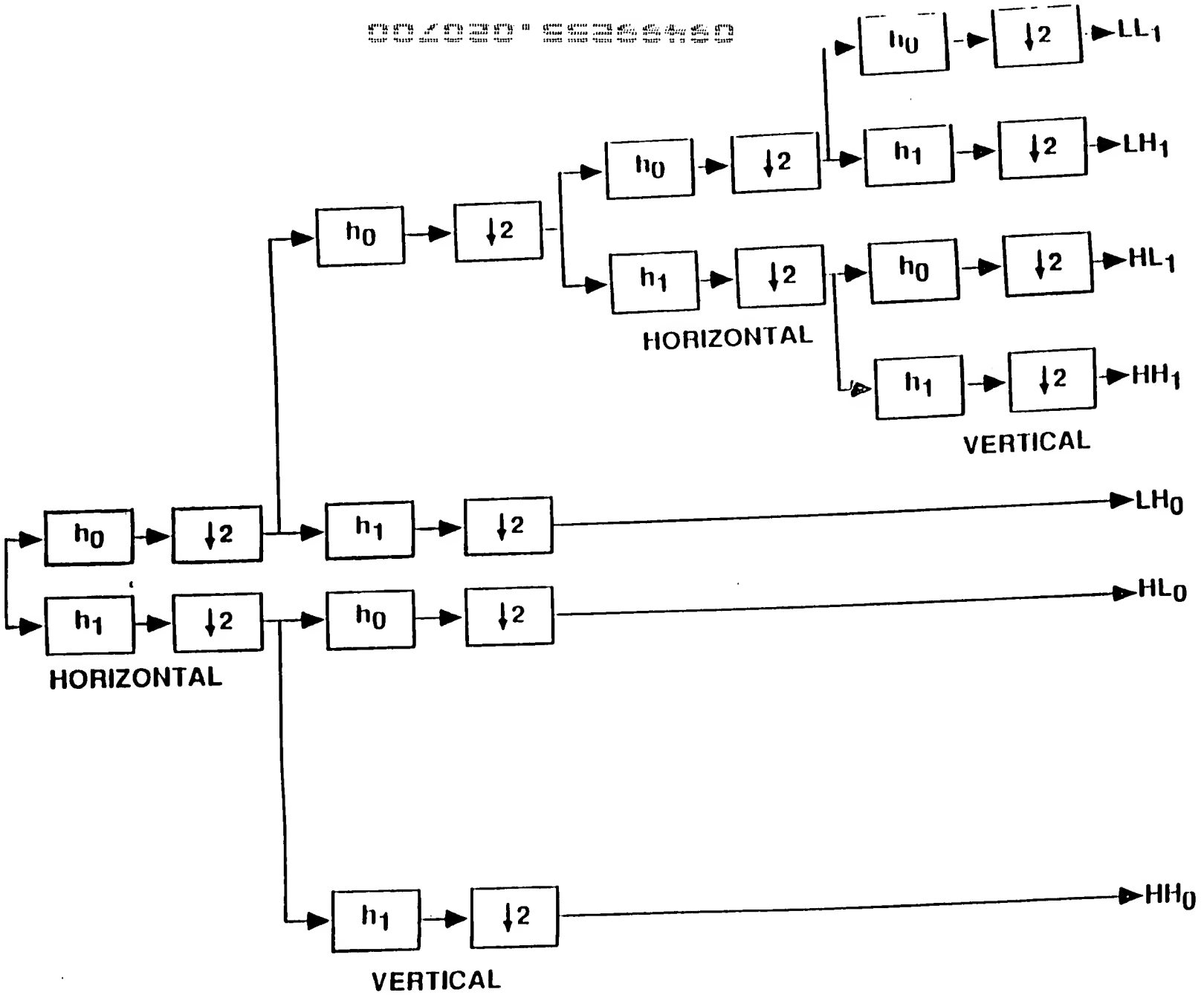



Figure 8

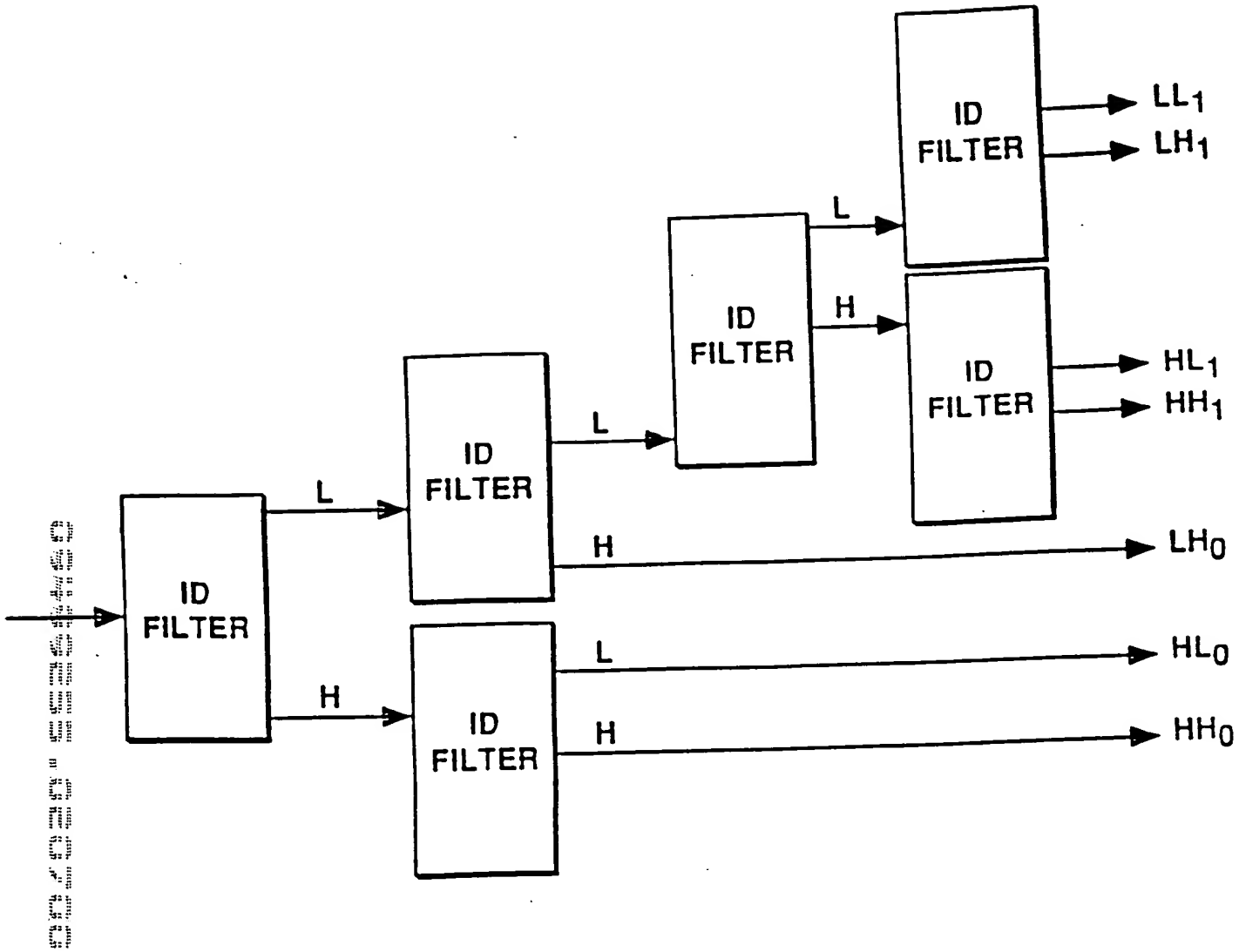

ID FILTER
L
H
ID FILTER
L
H
ID FILTER
L
H
ID FILTER
L
H
ID FILTER
LL1
LH1
HL1
HH1
LH0
HL0
HH0

*Figure 9*

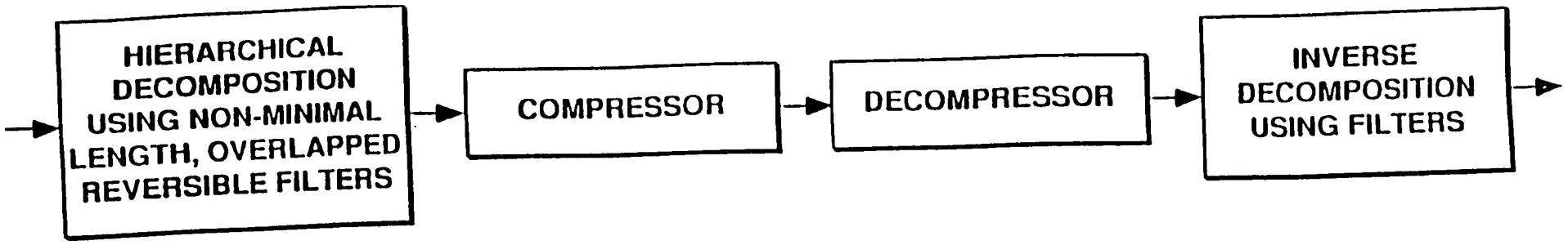



*Figure* 10

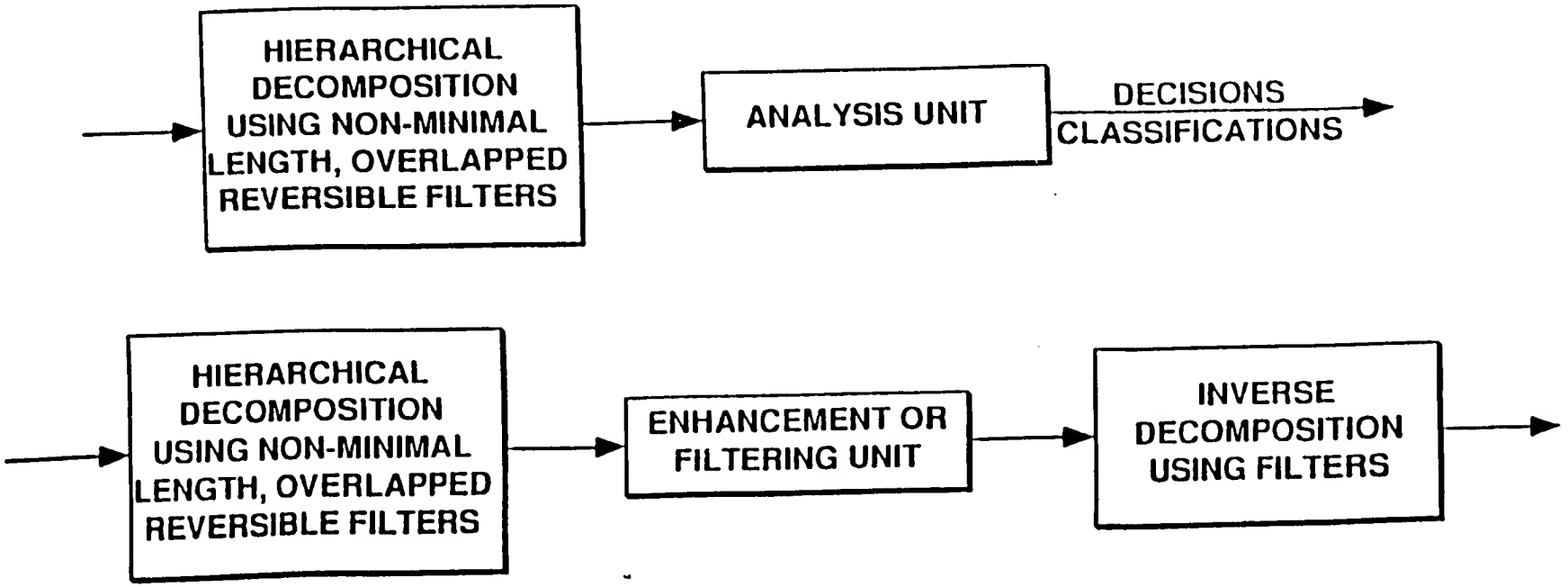



*Figure* 11

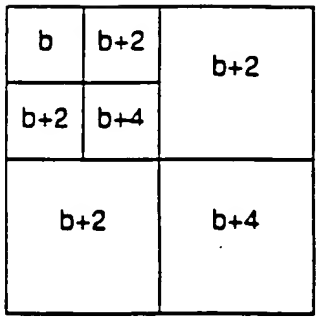



Figure 12A

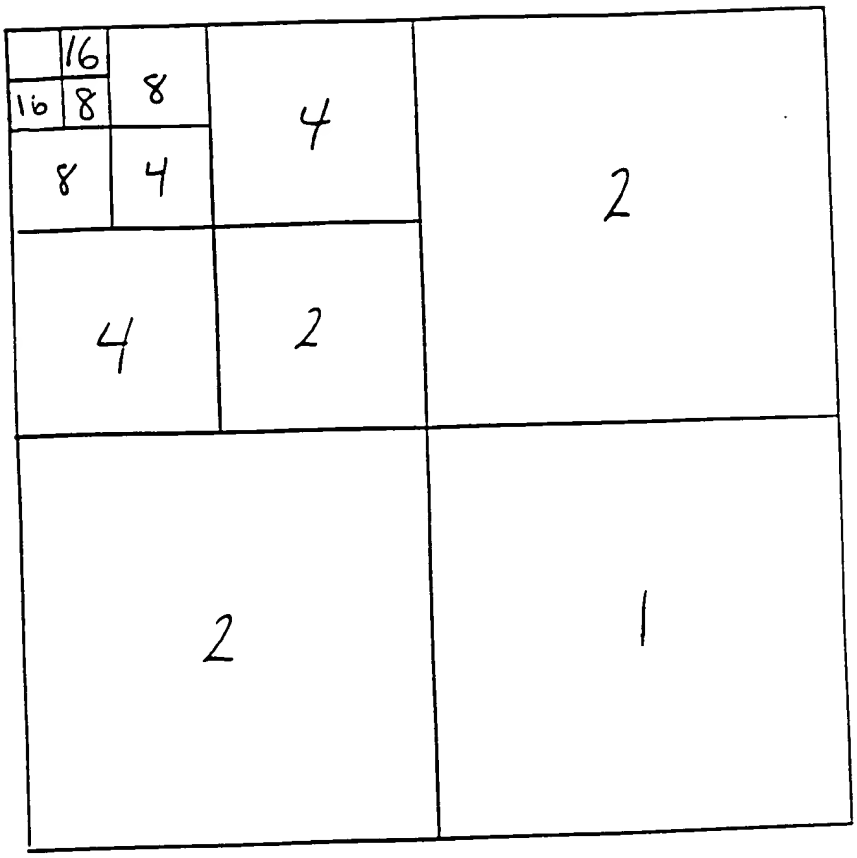



FIGURE 123

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

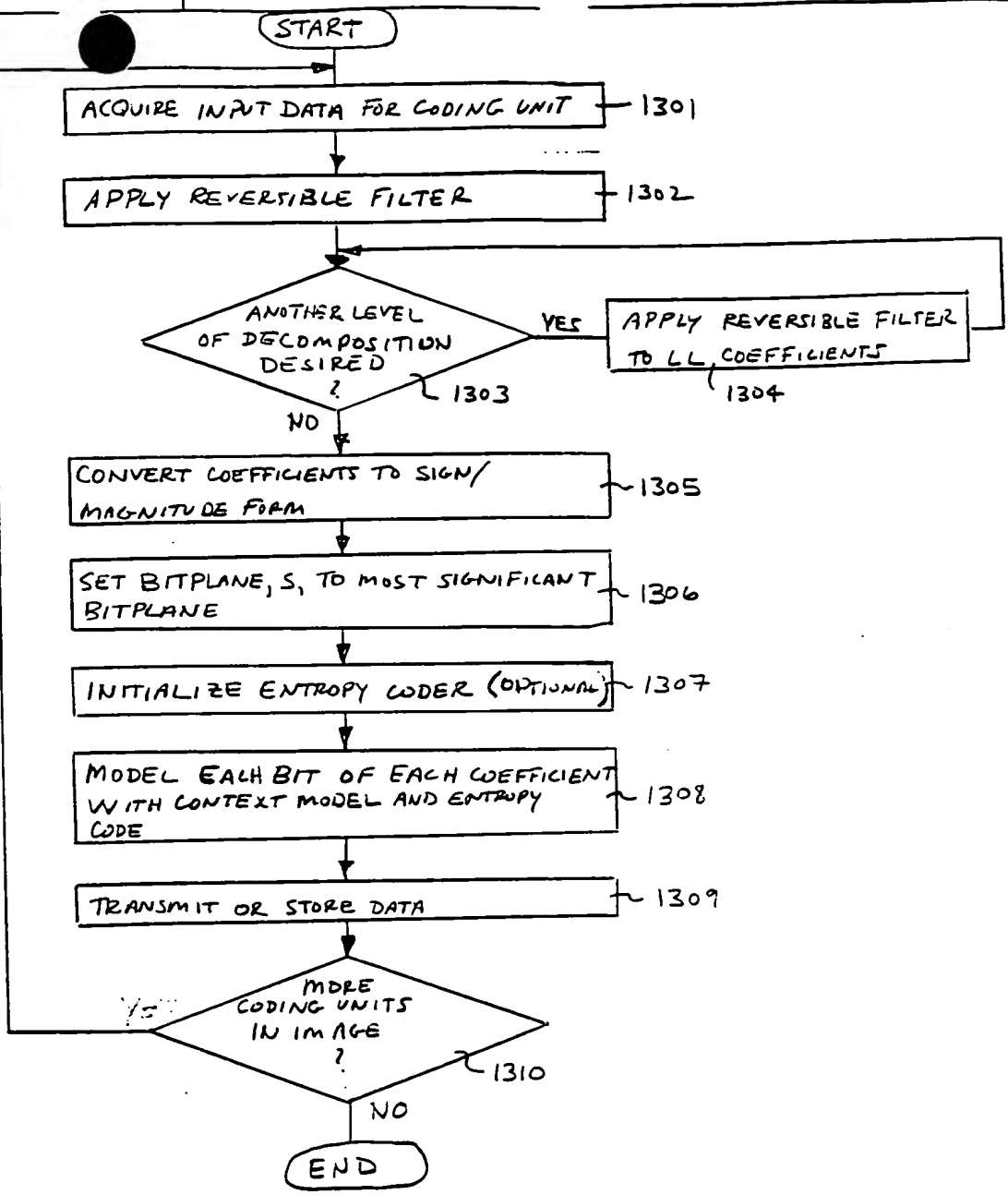



FIGURE 13

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

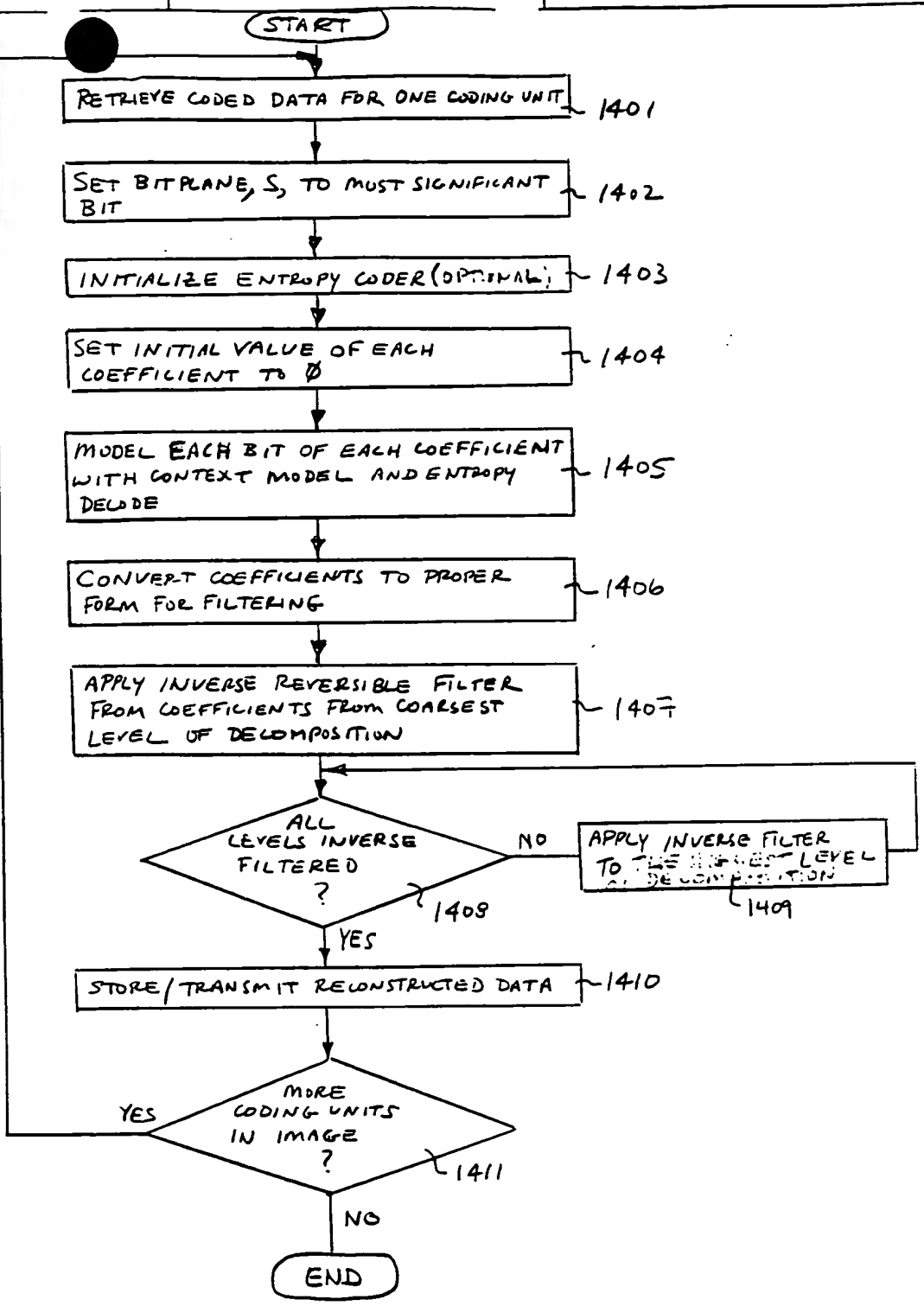



FIGURE 14

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

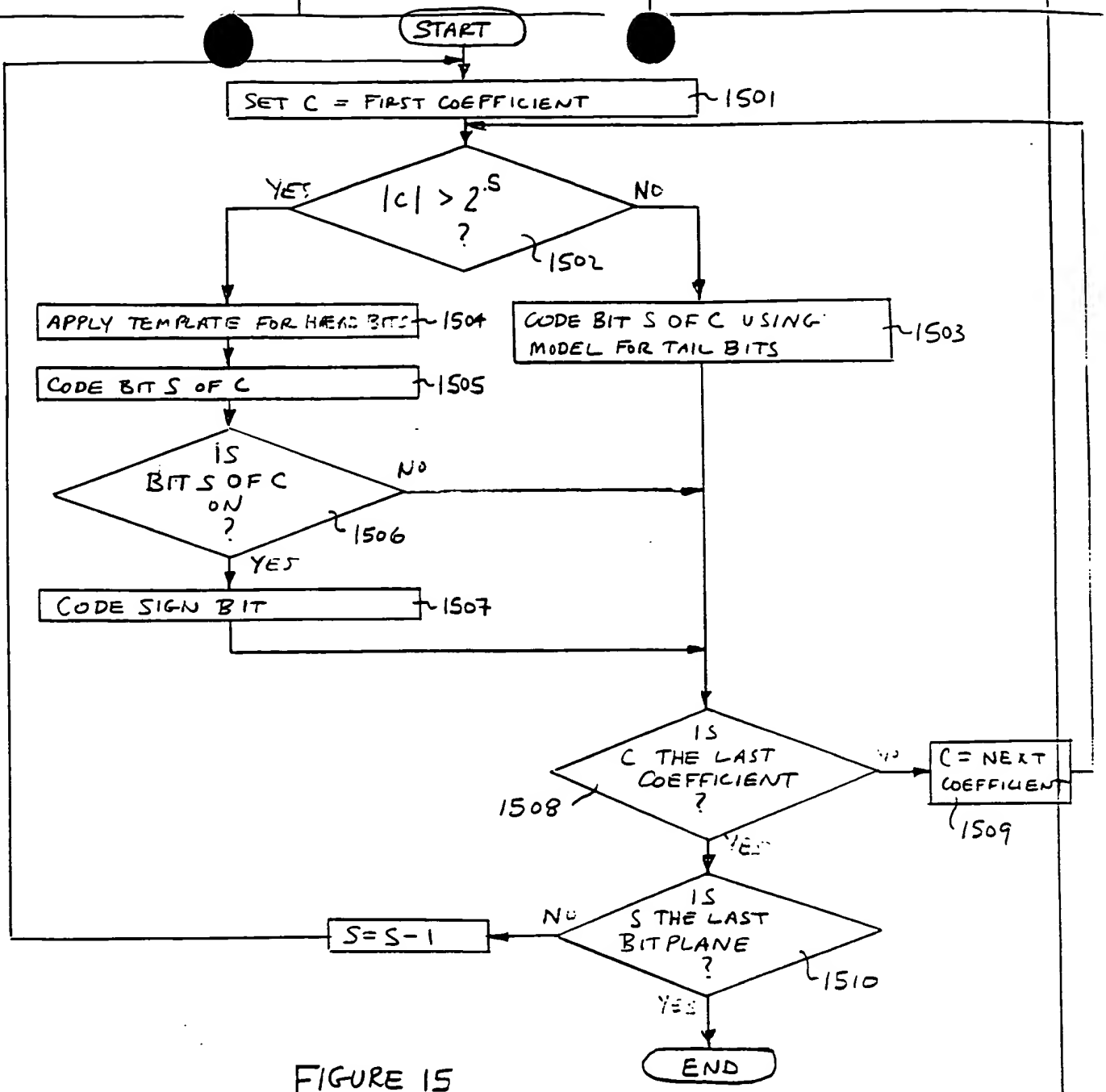



FIGURE 15

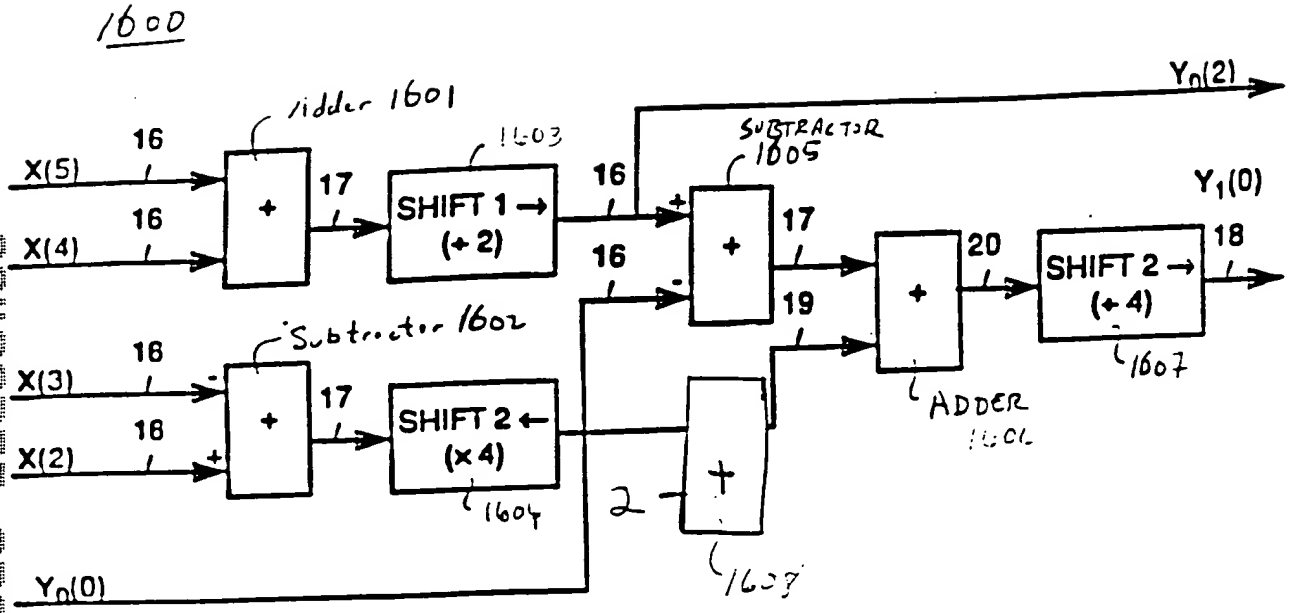

1600
Adder 1601
1603
SUBTRACTOR
1605
$Y_0(2)$
$Y_1(0)$
X(5)
X(4)
X(3)
X(2)
16
17
SHIFT 1 → (÷2)
SHIFT 2 ← (×4)
SHIFT 2 → (÷4)
20
18
19
Subtractor 1602
ADDER
1606
1604
1607
2
1608
$Y_0(0)$

FIGURE 16

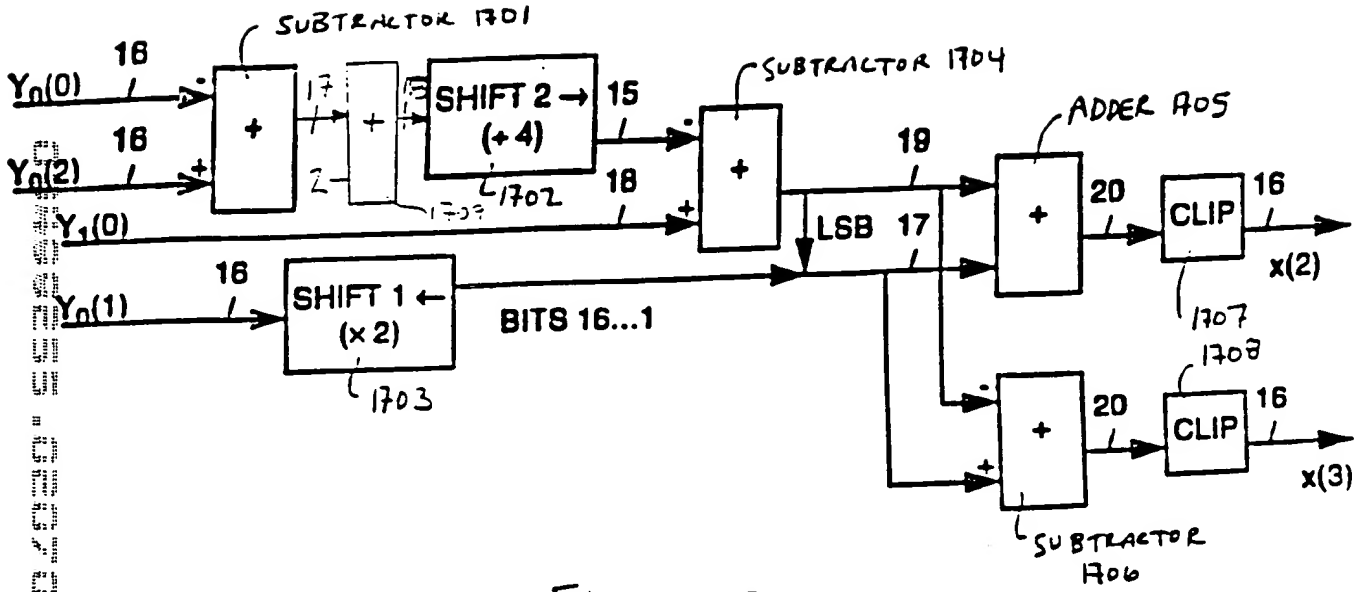
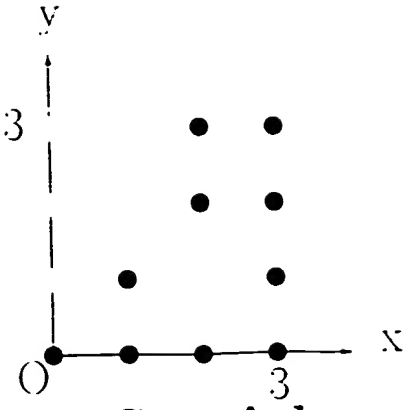
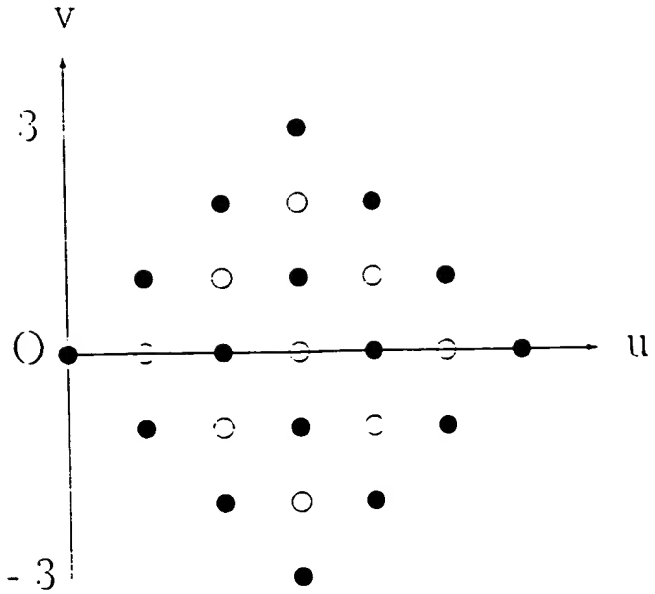

SUBTRACTOR 1701
16
$Y_0(0)$
16
$Y_0(2)$
$Y_1(0)$
16
$Y_0(1)$
+
17
+
2
SHIFT 2 → (+4)
1702
15
18
SHIFT 1 ← (×2)
1703
BITS 16...1
SUBTRACTOR 1704
+
19
LSB 17
ADDER 805
+
20
CLIP
16
x(2)
1707
1708
+
20
CLIP
16
x(3)
SUBTRACTOR 1706

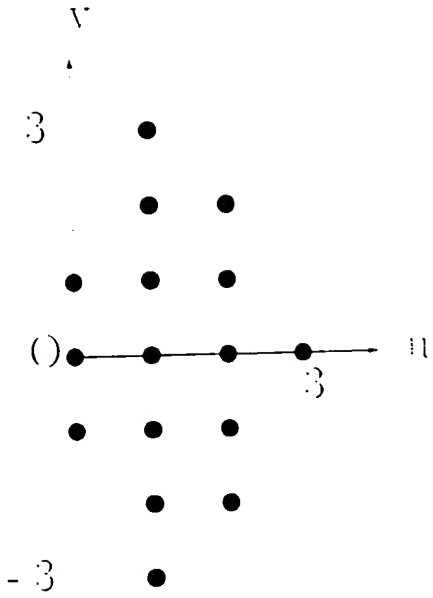
FIGURE 17




Spatial




Rational Hadamard




S-Transform

Fig. 18

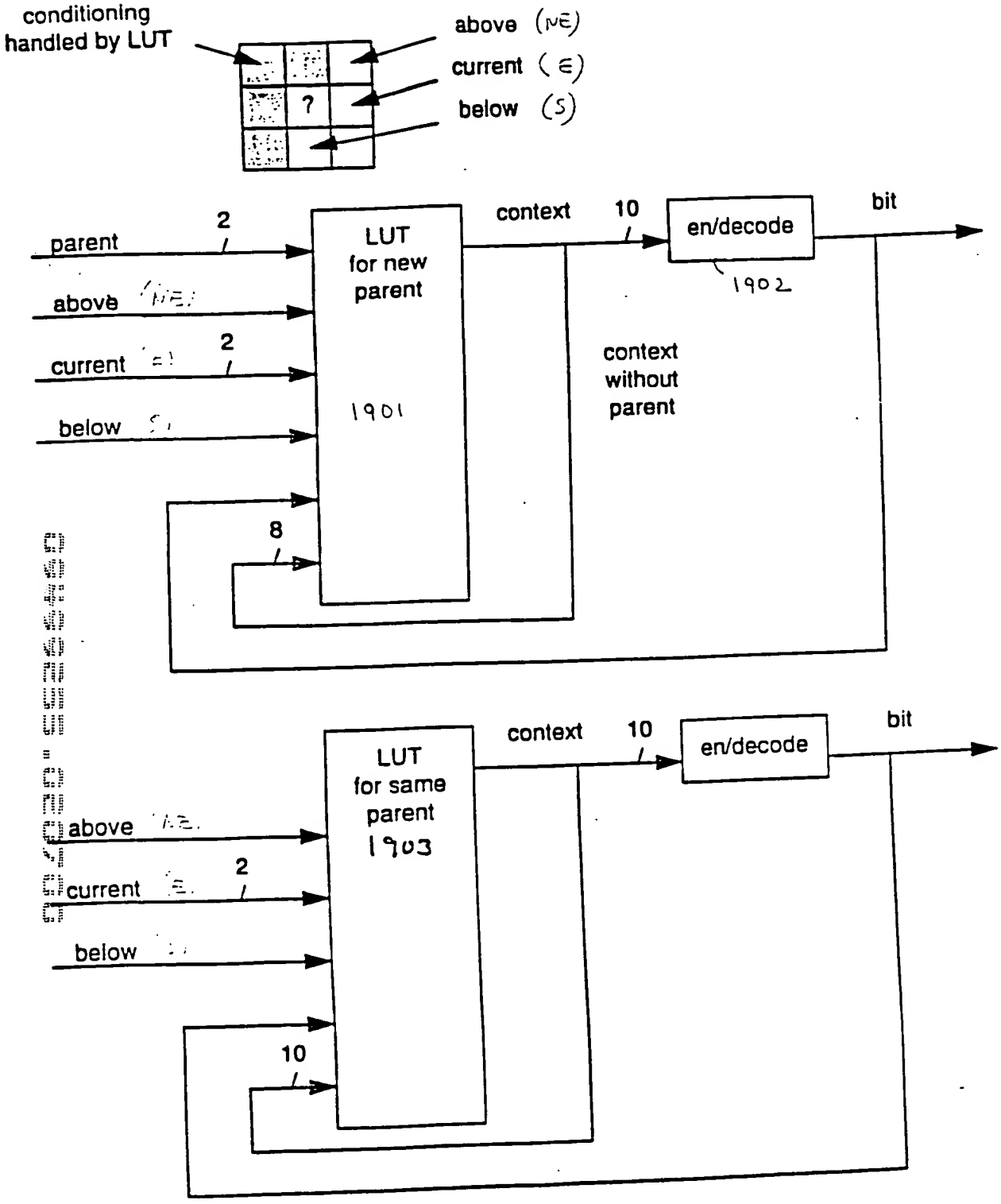



Figure 19A

Figure 19B

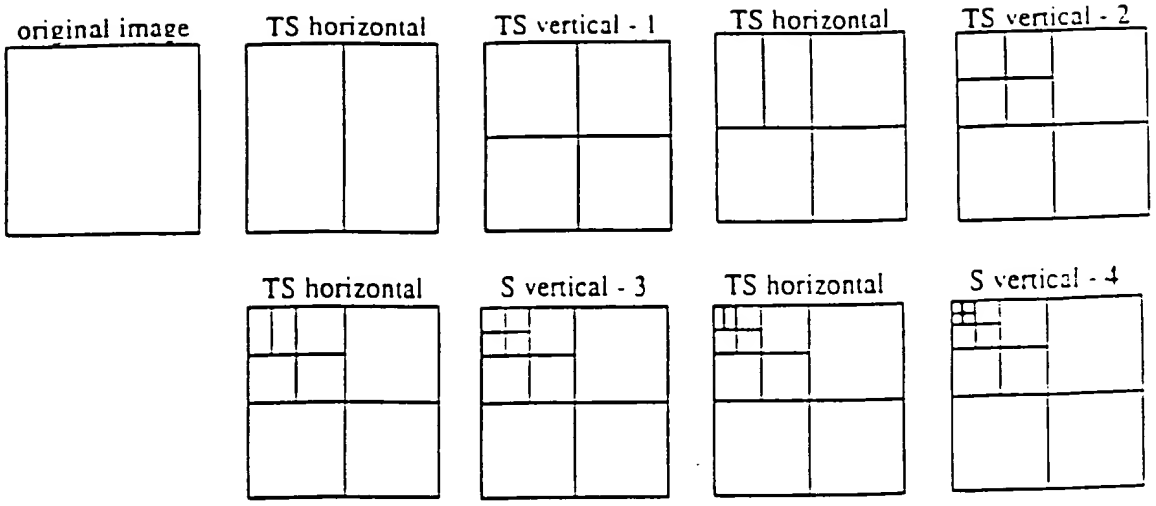

original image
TS horizontal
TS vertical - 1
TS horizontal
TS vertical - 2
TS horizontal
S vertical - 3
TS horizontal
S vertical - 4

FIGURE 20

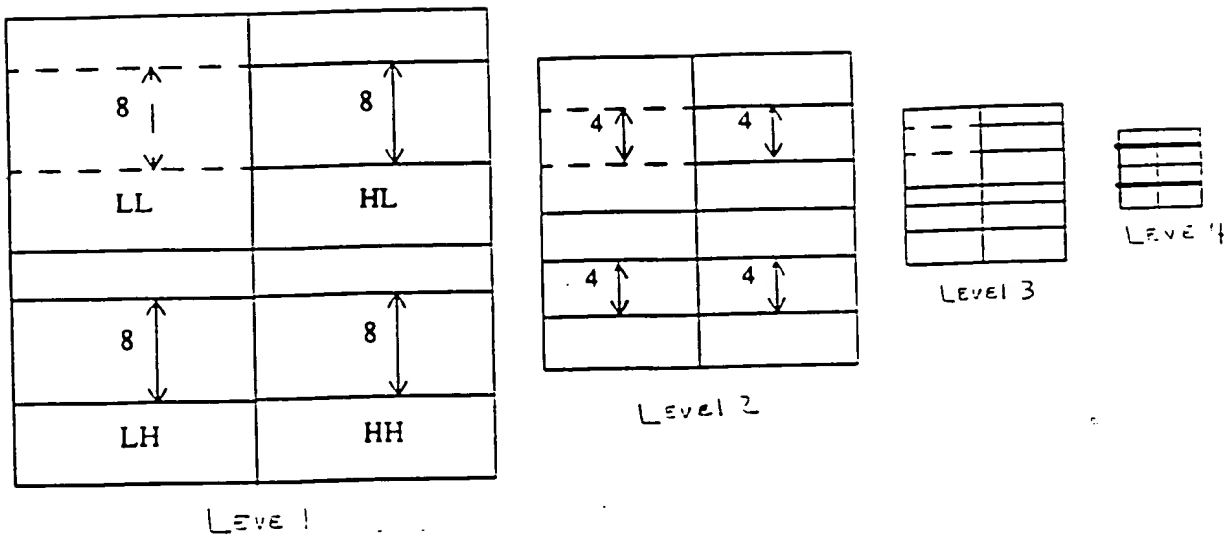



Figure 21

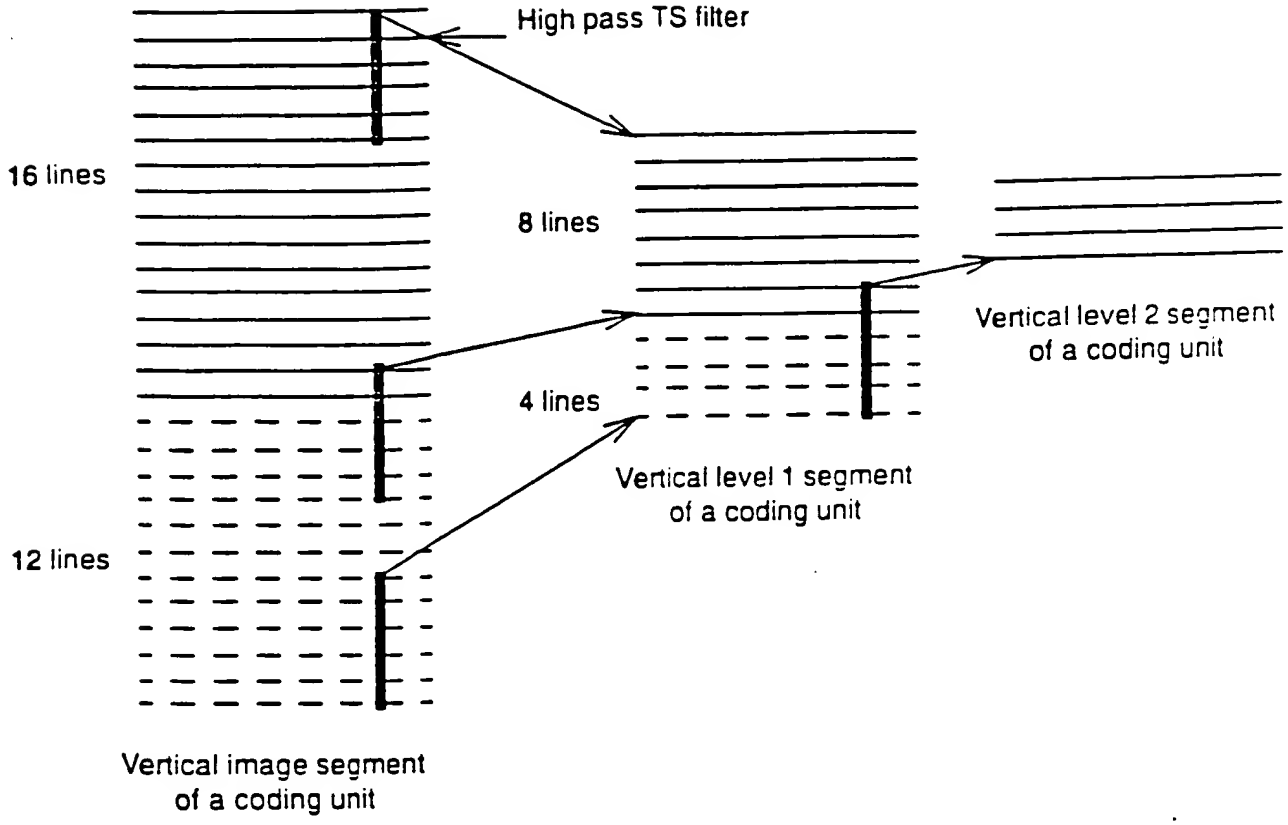

High pass TS filter
16 lines
8 lines
Vertical level 2 segment
of a coding unit
4 lines
Vertical level 1 segment
of a coding unit
12 lines
Vertical image segment
of a coding unit

Figure 22

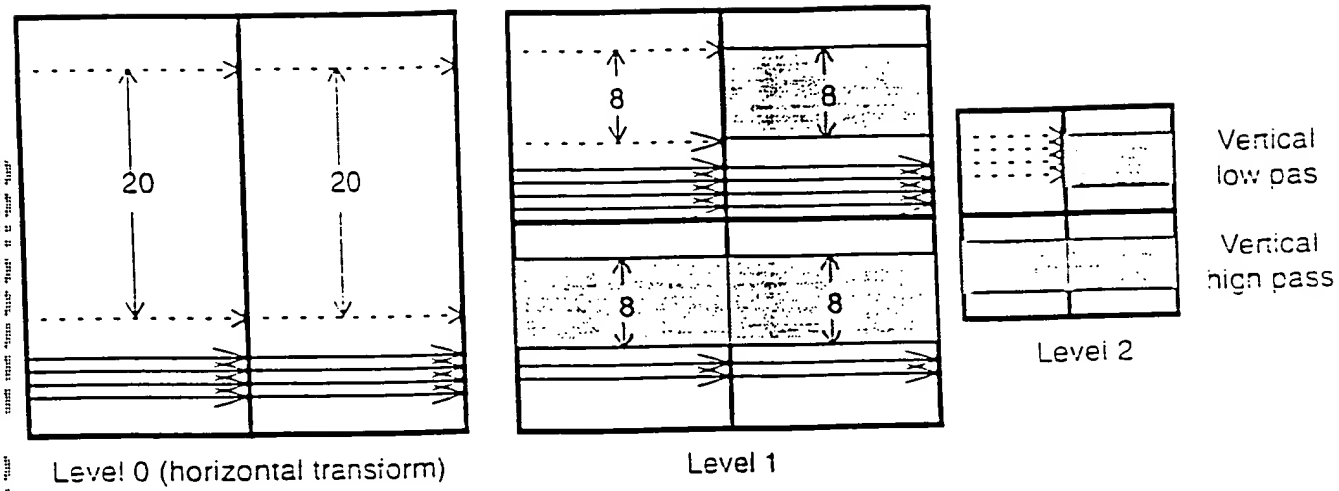

20
20
8
8
8
8
Vertical low pas
Vertical high pass
Level 0 (horizontal transiorm)
Level 1
Level 2

FIGURE 23

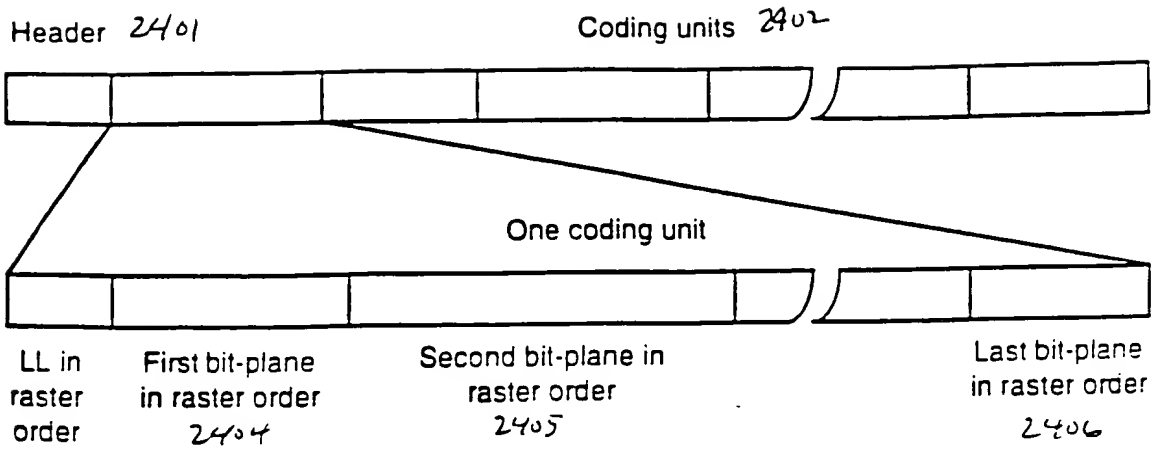

Header 2401
Coding units 2402
One coding unit
LL in raster order 2403
First bit-plane in raster order 2404
Second bit-plane in raster order 2405
Last bit-plane in raster order 2406

Figure 24A

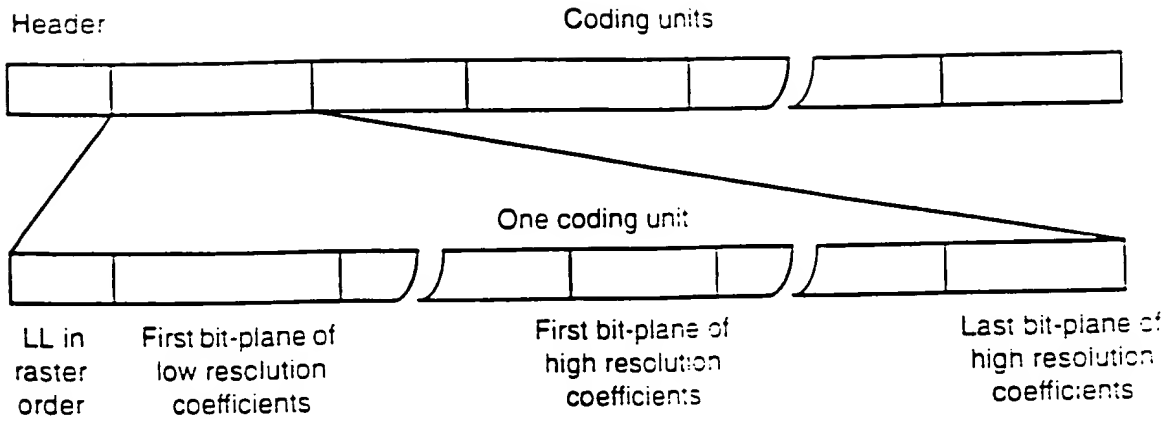

Header
Coding units
One coding unit
LL in raster order
First bit-plane of low resolution coefficients
First bit-plane of high resolution coefficients
Last bit-plane of high resolution coefficients

Figure 2-B

| | | |
|---|---|---|
| NW | N | NE |
| W | P | E |
| SW | S | SE |

Figure 25

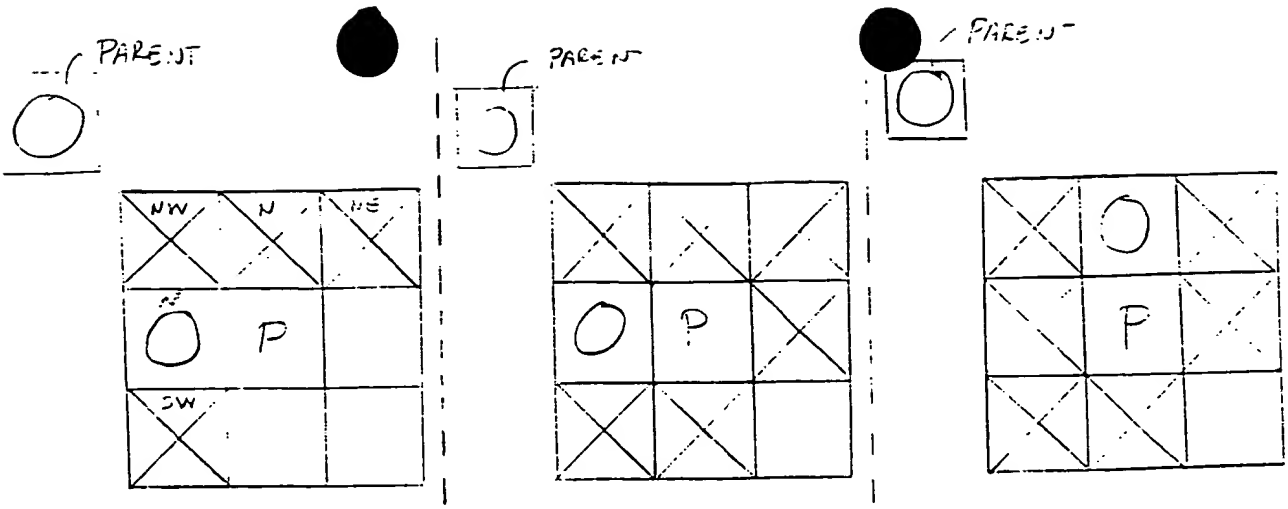



FIGURE 26A

FIGURE 26B

FIGURE 26C

X = tail-on bit (1 bit)

O = tail-on information (2 bits)

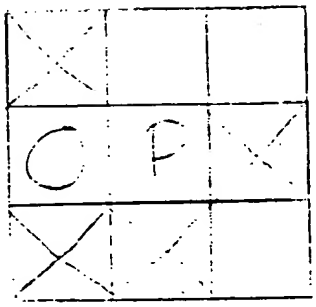



FIGURE 26D

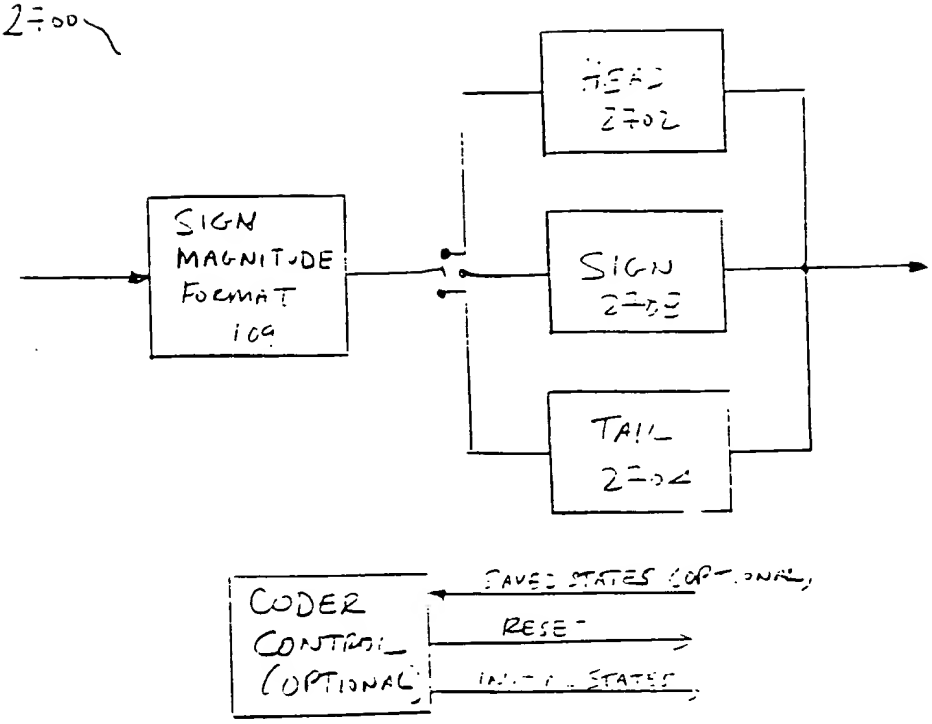

2700
HEAD
2702
SIGN MAGNITUDE FORMAT
104
SIGN
2704
TAIL
2706
CODER CONTROL (OPTIONAL)
SAVED STATES (OPTIONAL)
RESET
INITIAL STATES

Figure 27

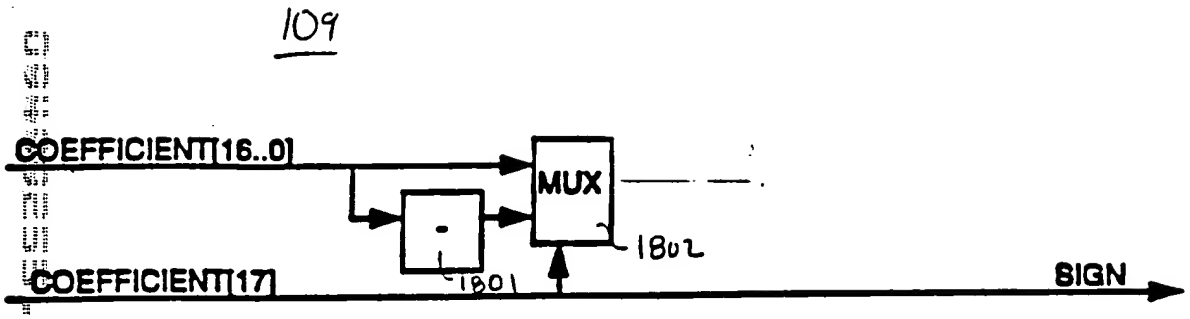



Figure 28

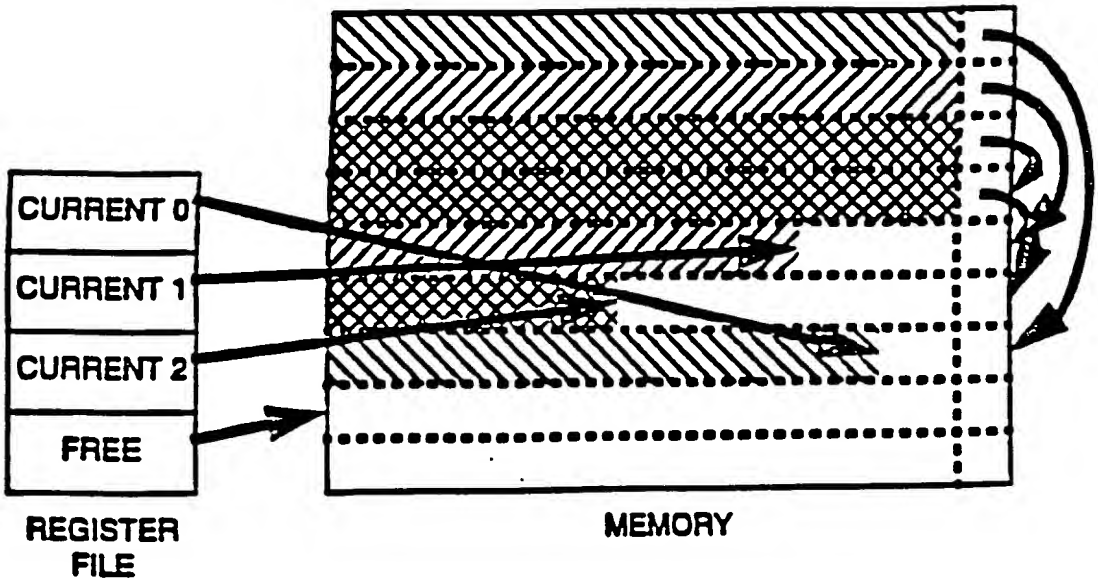



Figure 29

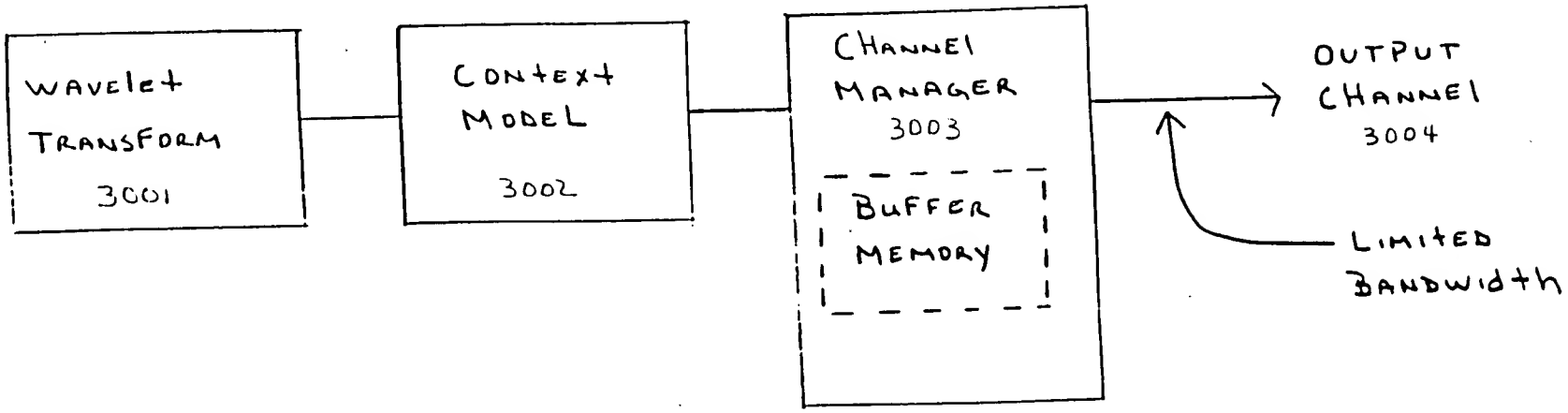

WAVELET TRANSFORM 3001
CONTEXT MODEL 3002
CHANNEL MANAGER 3003
BUFFER MEMORY
OUTPUT CHANNEL 3004
LIMITED BANDWIDTH

Figure 30

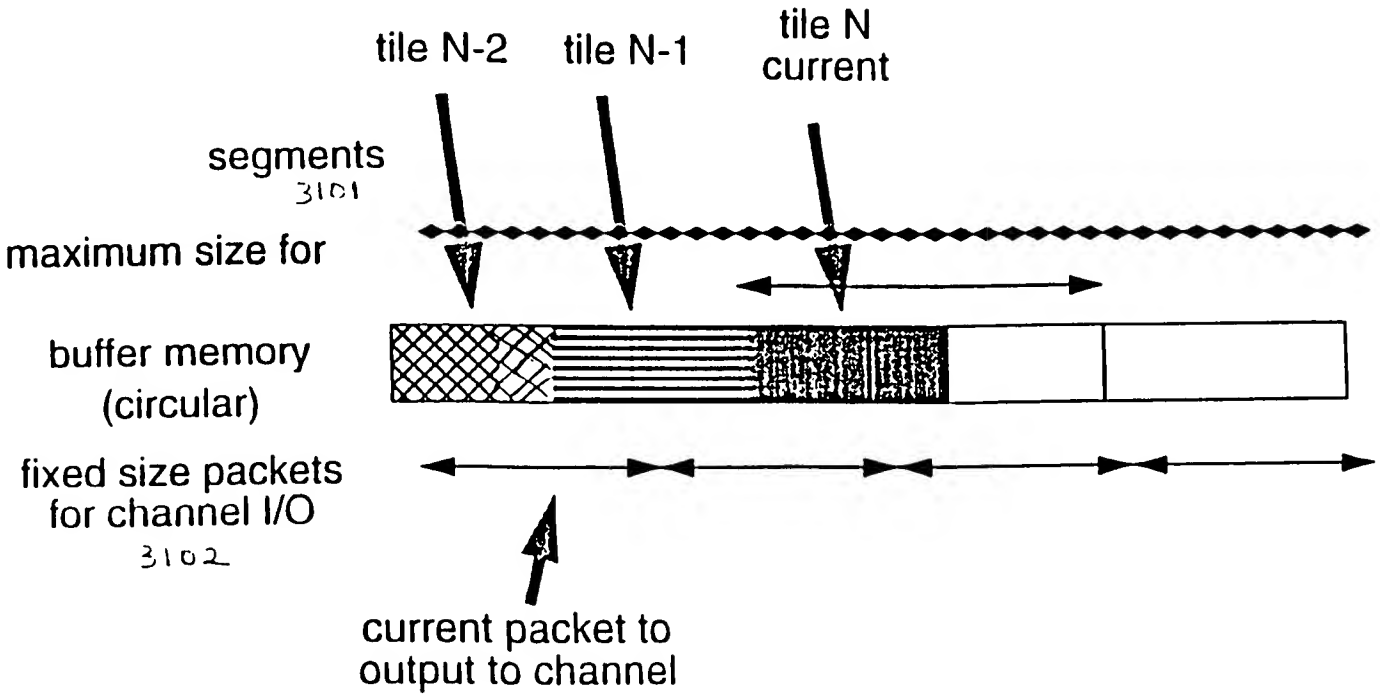

tile N-2
tile N-1
tile N
current
segments
3101
maximum size for
buffer memory
(circular)
fixed size packets
for channel I/O
3102
current packet to
output to channel

Figure 31

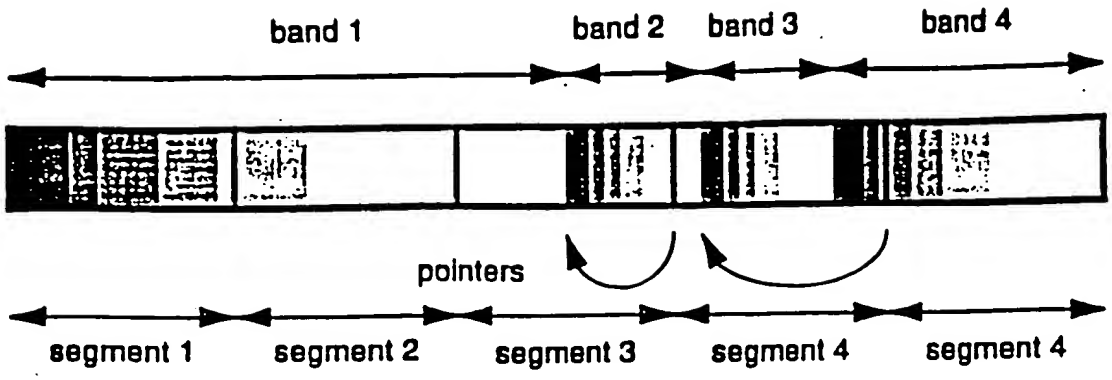



FIGURE 32

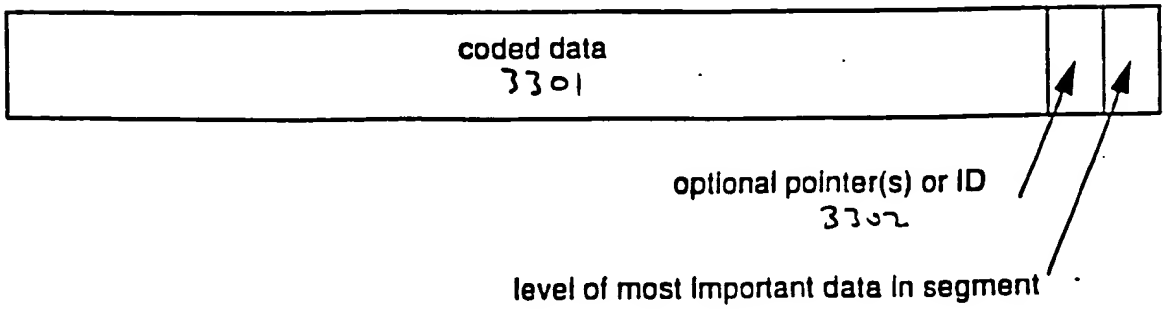



Figure 33

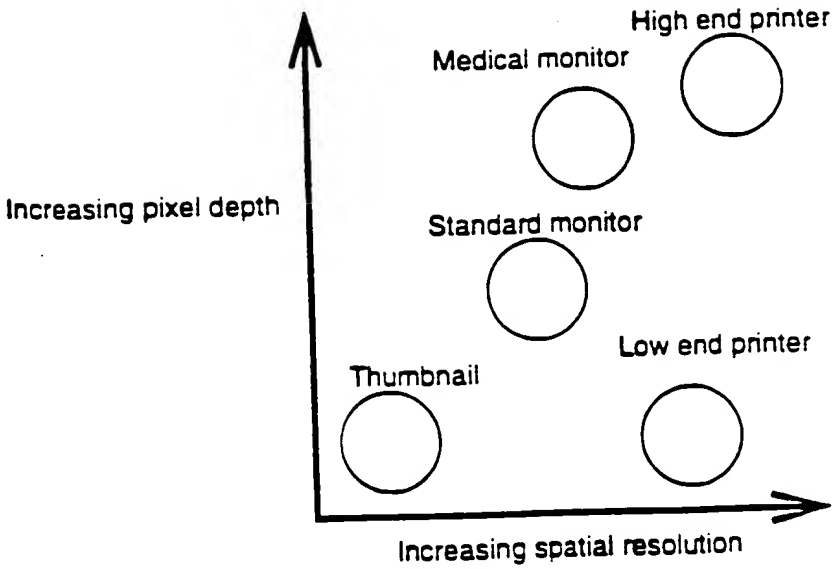
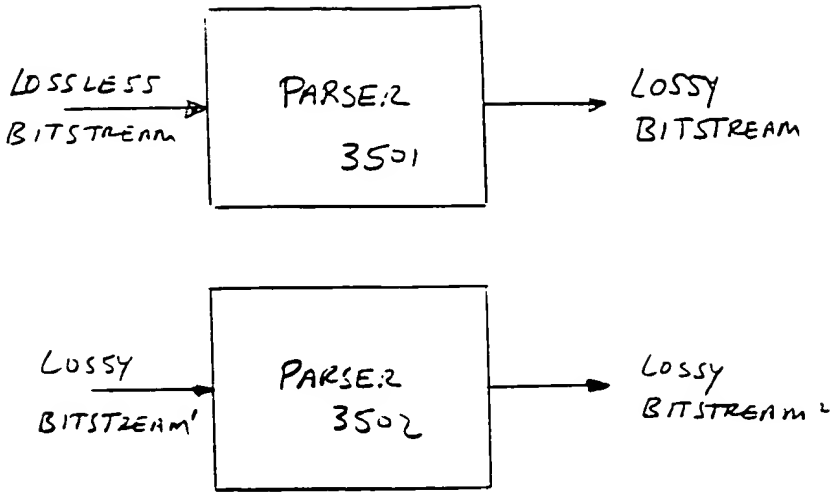

High end printer
Medical monitor
Increasing pixel depth
Standard monitor
Low end printer
Thumbnail
Increasing spatial resolution

FIGURE 34




BITRATE > BITRATE

Figure 35